Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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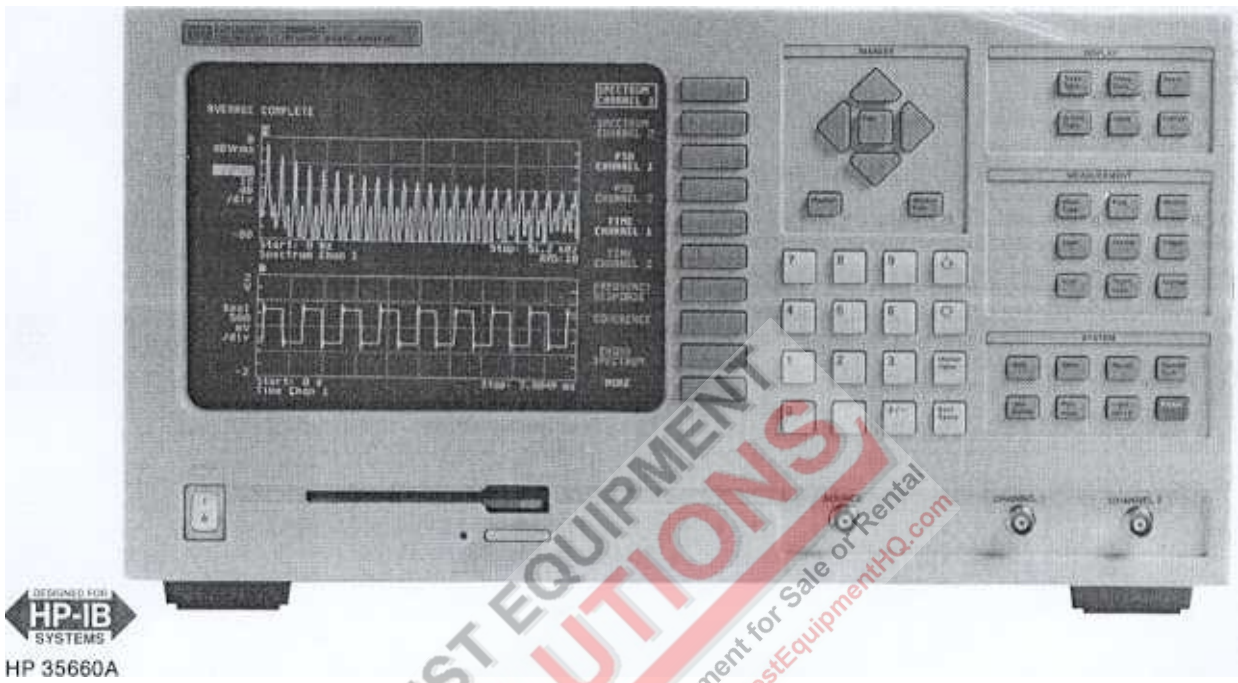
SIGNAL ANALYZERS

Dual-Channel, Dynamic Signal Analyzer 244 μHz to 102.4 kHz

Model 35660A

- Network and spectrum analysis
- 102.4 kHz single channel measurements
- 51.2 kHz dual channel measurements
- 401 line resolution
- 70 dB dynamic range
- ± 0.5 dB amplitude accuracy
- ± 0.4 dB and ± 1.0 degree channel match
- Frequency accuracy of ± 30 ppm



HP 35660A

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HP 35660A Dual-channel Dynamic Signal Analyzer

The HP 35660A Dynamic Signal Analyzer is an FFT-based instrument that provides spectrum and network measurements in electronics, mechanical test, acoustics, and other low frequency application areas. The analyzer also offers built-in test and automation features, traditionally available only with a computer. These features include an internal programming language (HP 35680A Instrument BASIC), a built in disc drive, limit testing and data tables. With automation built in, the HP 35660A can save you both time and money.

The HP 35660A performs spectrum analysis from 488 μHz to 102.4 kHz and network analysis from 244 μHz to 51.2 kHz. The FFT provides 401 lines of resolution in both one- and two-channel modes. Complete alias protection and digital zoom ensure high resolution measurements with warranted accuracy. Measurements include linear spectrum, power spectrum, frequency response, gain/phase, group delay, time history, and power spectral density. A built-in 3.5 inch disc drive, compatible with HP Series 200/300 workstations, stores traces, tables, states, and application programs.

Electrical Spectrum Analysis

The HP 35660A is typically 10 to 100 times faster than swept spectrum analyzers for equivalent measurements, and provides higher resolution (244 μHz throughout the 102.4 kHz frequency range). This speed and resolution contribute to the quality of HP 35660A tests for distortion, spur level, frequency drift, intermodulation, and other signal parameters. Amplitude accuracy of ± 0.5 dB and frequency accuracy of ± 30 ppm guarantee precision in tests of such devices as headsets, modems, telephone components, speakers, transducers, and electrical motors.

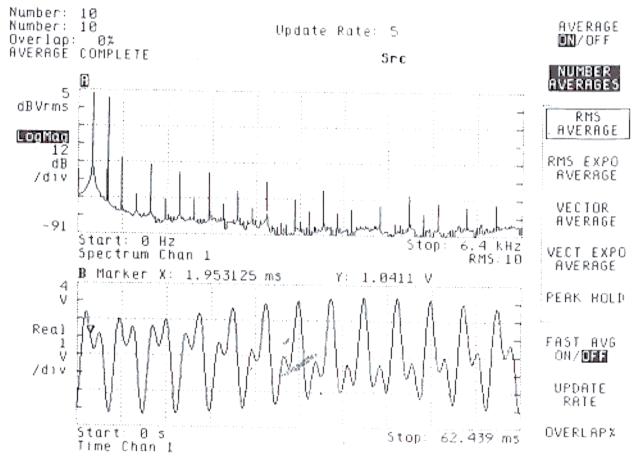
Electrical Network Analysis

With two input channels and a built-in source, the HP 35660A can quickly measure the response of low-frequency filters and networks. Source signals provided are random noise, periodic chirp, and fixed sine. Periodic chirp is useful for testing non-linear responses such as output clipping of amplifiers. Random noise is ideal to get a linear approximation of a non-linear network. Fixed sine lets you test response at a specific frequency.

The HP 35660A is also a good choice for low-frequency transmission measurements in telecommunications and other areas. To ensure highly accurate magnitude and phase measurements, the HP 35660A offers ± 0.4 dB gain and ± 1.0 degree input channel phase match. For custom analysis of these measurements, the HP 35660A provides waveform math, including conjugation, FFT, inverse FFT, square root, and frequency domain integration and differentiation.

Machinery Vibration

The HP 35660A is an excellent fit for applications that require vibration monitoring at full load. With the analyzer's built-in limit tables, users can implement vibration and health monitoring of engines, machine tools, and other equipment, without an external computer and without programming. The analyzer's internal disc drive makes it easy to record, store, and recall limits for production or maintenance testing.



Structural Analysis

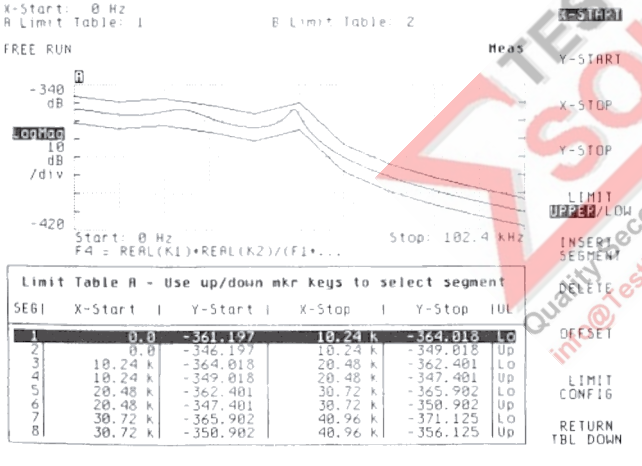
The HP 35660A uses force and exponential windows to perform frequency response testing of mechanical devices and structures. Using HP Instrument BASIC, the analyzer can simplify data collection for your modal surveys. For complete modal analysis, you can choose from several third party modal packages.

Acoustics

Another major application area for the HP 35660A is acoustics and noise measurements. This includes testing for room and device responses, noise identification and level, and underwater acoustic tests such as sono-buoy and sonar transducer testing. Acoustic intensity measurements are available with third party software.

Limit and Data tables for fast, consistent results

Spectrum and network analyzers are frequently used to test signals and device response against certain specifications. The HP 35660A improves this process by providing built-in limit testing. A limit line defines acceptable minimum and maximum values at specific X-axis points (in both time and frequency domains). Users can specify an upper and lower limit for every point in the trace, as well as specifying acceptable bands and slopes. During a test, the HP 35660A checks the trace level against the limit lines, then displays PASS or FAIL on the screen. Limit testing is especially powerful when used with HP Instrument BASIC. For example, a program can quickly pull limit lines off disc and use them as a reference against a series of traces.



Limit Table A - Use up/down mkr keys to select segment

SEG	X-Start	Y-Start	X-Stop	Y-Stop	UL
1	0.0	-361.197	10.24 k	-364.018	Lo
2	0.0	-346.197	10.24 k	-349.018	Up
3	10.24 k	-364.018	20.48 k	-362.401	Lo
4	10.24 k	-349.018	20.48 k	-347.401	Up
5	20.48 k	-362.401	30.72 k	-365.902	Lo
6	20.48 k	-347.401	30.72 k	-350.902	Up
7	30.72 k	-365.902	40.96 k	-371.125	Lo
8	30.72 k	-350.902	40.96 k	-356.125	Up

Data tables are another key feature of the HP 35660A. A data table eliminates the need to move markers along a trace to read multiple values. This is particularly useful for such applications as noise level monitoring at multiple frequencies. Enter up to 400 X-axis locations in a data table, and the HP 35660A fills in the table with a Y-axis value for each X entry. You can display, print, or store a completed table. For repeated measurements, you can create a unique table for each test and quickly recall each table from disc.

In addition to data tables and limit testing, the analyzer includes extensive markers to highlight harmonics and sidebands and to search for minimum, maximum, and target values.

HP-IB System Control

When used with HP Instrument BASIC, the HP 35660A can serve as a test system controller. A system might include peripherals such as hard discs, printers and plotters, as well as other instruments such as switch matrices, voltmeters and signal generators. You can automate smaller systems without the cost of an external computer, while conserving rack or bench space.

HP 35680A Instrument BASIC

To simplify automation and test analysis, the HP 35660A includes a powerful new feature: a subset of HP Series 200/300 BASIC running inside the analyzer. HP 35680A Instrument BASIC adds decision-making, branching, I/O including control of other instruments, and custom user interfaces. HP Instrument BASIC is fully syntax-compatible with HP BASIC, so current HP workstation owners can easily merge the HP 35660A and HP Instrument BASIC into their test systems.

A Language for Programmers and Non-Programmers

With over 150 BASIC commands, HP Instrument BASIC is a powerful tool for programmers. But it also includes a feature that makes it easy for non-programmers to automate analyzer functions. Keystroke recording automatically creates a program as the user makes measurements from the front panel. An entire test sequence can be recorded and saved with no programming required.

HP Instrument BASIC programs can be developed on an HP 9000 Series 200/300 BASIC workstation and then transferred to the analyzer via a 3.5 inch floppy disc (files must be saved in LIF format). Programs developed on the HP 35660A will also run on a workstation. If desired, the analyzer portion of a computer-aided test (CAT) can be created with keystroke recording, then merged with the main program written on an external computer. The HP 35660A is also fully HP-IB programmable from an external computer, using any language you choose.

Custom solutions with the HP 35660A

Applications that involve long and repetitive testing can benefit significantly from custom solutions available with the HP 35660A. For example, in a production environment, HP Instrument BASIC programs can automatically recall test setups and prompt a technician for date, time, and other important information. Limit testing can quickly indicate the presence of spurs or undesired harmonics. Operator interaction is further reduced with routines that automatically catalog results to a printer/plotter or to disc.

The HP 35681A Analysis Pack provides examples of how to customize the HP 35660A for specific applications. The Analysis Pack is a set of network and spectrum application programs that enhance the power of the HP 35660A analyzer.

Written in HP Instrument BASIC, the Analysis Pack provides several ready-to-use application tests, including distortion testing, filter parameter testing, and modulation and peak analysis. The Analysis Pack shows how easy it is to customize tests and provides a set of tested, documented routines you can re-use in your own custom applications.

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SIGNAL ANALYZERS

Dual-channel, Dynamic Signal Analyzer 244 μHz to 102 kHz

HP 35660A

HP 35660A Specifications

Frequency

Measurement Range: Channel 1: 488 μHz to 102.4 kHz, single channel mode. Channel 1 and 2: 244 μHz to 51.2 kHz, dual channel mode.

Accuracy: ± 0.003% of frequency reading

Resolution: Span/400, both channels, single or dual channel operation.

Spans:	Single Channel	Dual Channel
# of spans available	20 (x2 sequence)	20 (x2 sequence)
min span	195.3 mHz	97.6 mHz
max span	102.4 kHz	51.2 kHz
time record length	400/span	400/span

Window Functions: Flat Top, Hann, Uniform, Force, Exponential

Window Shape Parameters:

	Noise Equiv. BW (% of span)	−3dB BW (% of span)	Shape Factor (−60dB BW/ −3dB BW)	Window Flatness (dB)*
Uniform	0.25	0.25	716	+0, −4.0
Hann	0.375	0.37	9.1	+0, −1.5
Flat Top	0.955	0.9	2.6	±0.005

*relative to analyzer's 401 calculated frequency points

Typical Realtime Bandwidth: (random noise source off)

	Single Channel	Dual Channel
Averaging Off	800 Hz	400 Hz
Fast Averaging	3.2 kHz	1.6 kHz

Amplitude

Input Range: The calibrated input range is +27 dBV (31.7 Vpk) to −51 dBV (3.99 mVpk). Range is adjustable in 2 dB increments.

Dynamic Range: All distortion (intermodulation and harmonic) spurious and alias products < −70 dB relative to full scale input range.

Noise: (−51 dBV range, Rs = 50 ohms, 16 RMS Averages)
160 Hz to 1.28 kHz < −130 dBV/sqrt Hz (.316 μV/sqrt Hz)
1.28 kHz to 102.4 kHz < −140 dBV/sqrt Hz (.100 μV/sqrt Hz)

Common Mode Rejection: (Frequency <= 1 kHz)
−51 to −11 dBV Ranges (3.99 mVpk to 399 mVpk) >80 dB (typical)
−9 to +9 dBV Ranges (502 mVpk to 3.99 Vpk) >60 dB (typical)
+11 to +27 dBV Ranges (5.02 Vpk to 31.7 Vpk) >40 dB (typical)

Crosstalk: < −130 dB relative to the transmitting signal, or < −70 dB relative to the receiving channel range, whichever is greater. (Receiving channel input termination = 50 Ω)

Absolute Amplitude Accuracy: ± 0.5 dB ± 0.03 % of input range (488 μHz to 102.4 kHz, DC coupled)

Phase

Single Channel Phase Accuracy:
488 μHz to 10.24 kHz ± 4.0 degrees
(relative to external trigger, 16 vector averages, DC coupled, amplitude ≧ −50 dB relative to full scale)

Frequency Response

Gain Accuracy: ± 0.4 dB

Phase Accuracy: 488 μHz to 10.24 kHz ± 1 degree
10.24 kHz to 51.2 kHz ± 1.8 degree
(DC coupled, 16 RMS averages, 488 μHz to 51.2 kHz, Chl range = Ch2 Range, full scale periodic chirp input, Uniform window)

Inputs

Connection: Grounded or Floating

Input Impedance: 1 MΩ ± 10% shunted by < 100 pF.
Low to chassis in floating mode:
1 MΩ shunted by < 0.01 μF (Typical)
Low to chassis in grounded mode: 50 Ω (Typical)

Input Coupling: AC or DC coupling;
AC roll-off is < 3 dB at 1 Hz

Common Mode Range: (floating mode) ± 4V peak

Trigger

Internal: Positive or negative slope
Level: ± 100% of input range

External: TTL, positive or negative slope

Source

Source types: Random, periodic chirp, fixed sine

Output Impedance: < 5 Ω

Max. Output Level: ± 5 Vpk

Maximum current: ± 20 mA

Maximum capacitive load: 1000 pF

Sine:
Frequency range: 15.63 mHz to 102.4 kHz
Amplitude Accuracy: ± 4% Vpk (at 1 kHz, Vpk = .1V to 5V)
Flatness: ± 1.0 dB (relative to 1 kHz, Vpk= .1V to 5V)
Harmonic, subharmonic, and other spurious responses:
488 μHz to 10 kHz: < − 60 dB relative to source level
10 kHz to 102.4 kHz: < − 40 dB relative to source level
(Vpk= 0.1V to 5V)
Residual DC offset: ± 8.0 mV, ± 6.0% Vpk

Random:
Flatness: < 5.0 dB (typical)
(passband, relative to minimum amplitude in the frequency domain, Vpk = .1V to 5V, full span)

General
Power: 90 - 132 VAC, 48 to 440 Hz
198 - 264 VAC, 48 to 66 Hz
280 VA maximum

Weight: 22 kg (47 lbs) net
24 kg (52 lbs) shipping

Dimensions: 222mm (8.75") high
425.5mm (16.75") wide
538mm (21.19") deep

HP-IB

Implementation of IEEE Std 488.1 and 488.2
SH1 AH1 T6 TE0 L4 LE0 SR1 RL1 PP0 DC1 DT1 C1,C2,C3,C12 E2

Compatible Peripherals

Disc Drives: HP SS/80 Protocol Disc Drives (These include the 9122C,D,S; 9133D,H,L; and HP 9153A,C)

Plotters: Hewlett-Packard Graphics Language (HP-GL) digital plotters

Printers: HP-IB printers, alpha and raster dumps.

Ordering Information

HP 35660A Dynamic Signal Analyzer
Option 001 Add 2 Mbyte RAM
Option 002 Delete disc drive
Option 908 Rack mount kit
Option 910 Extra Operating Manual Set and HP-IB Programming Reference
Option 915 Service Manual and Kit
Option W30 Extended repair service. See page 725.
HP 35680A Instrument BASIC
HP 35681A Analysis Pack

Accessories Supplied
Operating and Programming Manuals, HP 35660A performance tests

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